DOCUMENT RESUME

ED 320 914 TM 014 795

AUTHOR Bierschenk, Bernhard
TITLE Behavioural Semantics: A Comparison between Topologic and Algebraic Scaling in the Measurement of Human Dignity. No. 33.
INSTITUTION Lund Univ. (Sweden). Cognitive Science Research.
PUB DATE 90
NOTE 24p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adults; Algebra; Behavioral Science Research; *Classification; *College Students; Comparative Analysis; Content Analysis; Definitions; Factor Analysis; Foreign Countries; Graduate Students; Higher Education; High Schools; *High School Students; *Human Dignity; Language Patterns; Personality Measures; *Scaling; *Semantics; Statistical Analysis
IDENTIFIERS Eigenvalues; Sweden; Worth

ABSTRACT

Topological and algebraic scales were compared in the representation of the concept of human worth in behavioral-semantic terms. In a first experiment, seven doctoral students of Business Administration in Sweden explored the notion of worth using definitions from at least 10 dictionaries as the intentional-semantic content. Each subject served as experiencer, observer, and recorder in grouping entries by content. On the basis of the differentiations presented and names proposed for each of the groupings, the prototypical character of the groupings were summarized using the following descriptive names: (1) eigenvalue; (2) reputation; (3) reliability; (4) impartiality; (5) rank; (6) significance; and (7) status. The structural connections were represented topographically. In a second experiment, 180 Swedish high school students, college students, and adult professionals were asked to make preferential judgments about the intentional-semantic content of 50 statements about worth prepared by the subjects in the first experiment. A statistical analysis of choice alternatives then established an algebraic scale. Factor analysis led to the conclusion that the structure of the investigated concept was qualitatively invariant. The topological scale was preferred because it gave a synthetic representation of the underlying structure, while the algebraic scale only gave an analytic representation of details. (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

BERNHARD BIERSCHENK

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Behavioural Semantics

A Comparison between Topologic and Algebraic Scaling in the Measurement of Human Dignity

Bernhard Bierschenk

Behavioural Semantics
A Comparison between Topologic and Algebraic Scaling in the Measurement of Human Dignity

Bernhard Bierschenk

1990 No. 33

Communications should be send to:
Cognitive Science Research
Paradisgatan 5
Lund University
S-223 50 Lund, Sweden

Coordinator: Bernhard Bierschenk
Department of Psychology

The Subject-Object Distinction

Originally, psychology was conceived as the science of consciousness. In order to explore the perceptual basis for the correlation between mental processes and language it became necessary to characterize the perceptible world, on the basis of an analysis of modalities and attributes. A traditional and thus, positivistic description of mental processes required a separation of the subjective from the objective. All methodological effort was directed toward a research that would lead to the establishment of "mental test scores" (Lord & Novick, 1967) in order to explain how perceptual experience is related to the physical world. This procedure required the initiation of objective observation processes, i.e. experiments in which the methodological approach guarantees that all subjective noise would be at a minimum or excluded. Generally, it was expected that the originally subjective by means of the scientific method would become objective. The general mechanism of synthesis assumed by Wilhelm Wundt (1832-1920) and Edward Bradford Tichener (1867-1927) was association. They hoped to be able to describe the "meaning" of sensations through the abstracted and idealized subject. Moreover, once it was objectified it could be a component in the calculation of the "formal structure" in the results of an experimental investigation. By applying the rules of "extensional logics" (Hartman, 1967 p. 55) in the calculation of the contents of the perceptual world, an a priori basis is established for the correct and universal knowledge of psychological phenomena such as consciousness.

In objectifying consciousness, it was assumed that the positivism of Auguste Comte (1798-1857) could be made the basis of the study of almost anything that experimental subjects were able to discriminate reliably. But the tie between "attribute" and "sensation" was first cut when positivism developed into behavioural semantics. Stimulated by the scientific dispute associated with the "Wiener Kreis" a strict behaviouristic approach was found to be the only way to circumvent the intentionality of the subject. It was Broadus Watson (1878-1920) who announced at the turn of the century that the scientific study of behaviour could be carried out without any mentalistic explanation or any assumption of mental causes. This thesis was further developed by Burhus Fredric Skinner (1904-), who studied the ability of experimental

subjects (pigeons) to discriminate between two or more stimuli. The solution of the measurement problem posed was the construction of observation protocols over unusual responses of the behaving organism. In approaching the measurement problem, behaviourism considered all mental processes as physiological.

Researchers with a strict behaviouristic outlook have denied the existence of mentality as well as the import of language in the measurement of mental processes. The bridging from pure physiological and physical descriptions to the psychological explanation has often been left out or, at best, has been of speculative nature. Therefore, it may be worth noting here that already Pavlov (1849-1936) came to the conclusion that intentional control always involves language as medium of communication.

The Psychometric Foundation of Categorical Judgment

In order to account for language usage behaviourism was modified into a behaviourism in semantic form. It was Osgood, Saporta & Nunnally (1954) who assumed that sensation is a special kind of perception resulting in an abstractive and valuative assertion. This special kind of perception implied that a generalization of the concepts "attribute" and "sensation" made it possible to study language expressions with the models of behaviourism. From the measurement point of view it was Torgerson (1958 p. 26) who used the term "attribute" for a measurable property and "magnitude" for the manifestation of the stimulus. By simplifying the conditions of stimulation and controlling experimentally the nature of the variation in the binary relations of stimulus-response pairs, it was possible to generate mental test scores by the methods of psychophysical and psychological scaling (Bock & Jones, 1968) on the basis of which "metathetic" and "prothetic" continua (Stevens, 1975 p. 13, 227-267) could be explored.

The salient characteristic of the generated sets of behavioural data is their physical existence. Physical existence is the necessary condition for collecting, sorting, counting, comparing, measuring and classifying behavioural facts. Thus, generalized attributes can be divided along a qualitative and a quantitative dimension. That some stimulus (x) has the subjective quantity (y) where y might be a preference magnitude can

thereafter be analyzed by means of statistical operations or transformations.

The general principle governing the measuring process within the behavioural science tradition implies that a stimulus which can be distinguished and separated from some other stimulus can be scaled, maybe only at the nominal level. Thus, scaling is an empirical measurement problem which means that scaling procedures transform theoretical ideas and concepts into variables. All procedures requiring the experimental subject to estimate the magnitude of a stimulus by judging an object on the basis of categories imply that some intervening frame of reference is part of the judgmental process. In the test instructions the subject is asked to compare differences or intervals. These are produced by category based scales where the categories have been assigned labels. The labels put some restrictions on the categories. It is assumed that the interpretation of the labelled categories is independent of the stimulus object to be judged. If this assumption is satisfied, results from the judgment of different objects can be compared. Further, Stevens (1975) has shown that category based scales can be converted into ratio scales and studied by means of some power function for the magnitude of a stimulus object. This is possible by rewording the instructions such that the subject can make judgments independent of categorical restrictions.

The measurement operations incorporate two basic components. One is connected to the generation of sets of data and the other to the statistical processing. Many researchers have taken the position that measuring procedures and statistical analyses are independent of each other. A result of this opinion is that behavioural data sets are processed without consideration of the specific conditions and assumptions of the model of measurement. The resulting analytical concepts are conceived as scientific constructions that have the task to organize and structure observations. Consequently, the notions "true" and "real" (Horst, 1966, p. 248) make little sense and have been substituted by the notions "construction", "operation", and "criterion". With respect to the application of statistical operations this relaxed attitude paves the way for the discovery of important empirical relations and theoretical formulations. Moreover, this liberty has often resulted in

the determination of adequate measuring scales. Nevertheless, a serious analysis of the measurement process shows that the statistical models as intervening variables influence the measuring operations as well as the measuring models.

In conclusion, experimental subjects can judge analytical propositions with respect to their intensive magnitude. They can also by an abstractive act of attention judge the (dis)similarity of two objects. The ability to abstract attributes and to make judgments of them is the foundation on which behavioural semantics is built.

Verbal Reports as Behavioural Referents

In the study of communicative trans-action, language is conceived as a behavioural stimulus-response network. The task of the behavioural scientist is to observe the significant actions and to organize them according to some a priori defined classification system. Verbal behaviour is transformed by means of procedures which have become known as content analysis. It is assumed that the "meaning" of verbal behaviour can be computed and semantically determined. As a method, content analysis has its roots in ancient Greek. It was applied with the aim of solving problems by argumentation at public places such as markets (i.e. katagoreuein). A categorisation and classification process, therefore, is central for the analysis of the content of verbal behaviour.

Examples of types of content analysis. For the behavioural scientist, the analytical problem consists in the generation of behavioural particulars on the basis of the behavioural text (i.e. itemization of verbal expressions). Behavioural text can be studied either with techniques that (1) do or (2) do not require distributions of frequencies. In principle, techniques based on the proposition of the presence or absence of a particular attribute are commonly used for diagnostic purposes. A well defined scientific concept which can specify and guide the process of identifying and extracting significant referents is usually absent. Techniques based on frequencies, on the contrary, require an explicit formulation of the strategies leading to the computation of analytical concepts. A content analysis is object governed and possible if and only if the itemized verbal expressions can serve as symbols for behavioural facts. Techniques and procedures connected

with the content analysis method help to objectify and quantify descriptions of the surface features of a behavioural text which gets its semantic meaning in terms of classes and class relations. In the attempt to establish its semantics, content analysts try to satisfy the requirements of intersubjectivity (Bierschenk & Bierschenk, 1976; Bierschenk, 1978; Gottschalk, Lolas & Viney, 1986). Psychometricians (Horst, 1966, p. 268) regard the method as obscure and consequently, its procedures as inappropriate for a reliable measurement of psychological concepts.

Unrestricted and Restricted Response Alternatives

The scientific literature on the treatment of human thinking, action, and opinion as it is reflected in the unrestricted format of natural language expressions is extensive. The same is true for the literature on the formatting of restricted response alternatives for the measurement of human thinking, action and opinion. Comparative studies of both methods of investigating psychological constructs are considerably less extensive. Frederiksen (1984, p. 197) could locate only studies concerned with "free-response forms that were adaptations of multiple-choice tests". In evaluating the results, he found that the format for the kind of tests studied "at most makes a small difference".

Frederiksen's (1984, p. 198) own studies show very low correlations when the multiple-choice tests are adaptations of free-response tests intended to measure complex mental operations in subjects' who were assigned the task to use a hypothesize-and-test procedure. The material prepared for that purpose consisted of short descriptions of behavioural research studies, a graph or table showing the results, and a statement of the major results. Under the free response condition of the experiment, the task was to write down possible explanations or hypotheses. For the purpose of format comparison a list of tabulated hypotheses written under the free response condition, were at a later stage presented in a multiple-choice format. Scores were obtained that reflected the quality and number as well as exceptional written hypotheses. With reference to the experimental task, Frederiksen concluded that the two formats do not measure the same constructs.

The experiment seemed to be motivated by the assumption that a

qualitative analysis of the verbal expressions produced by the experimental subjects would be closer to subjectivity and insight. Moreover, the imprecise content analysis gave the impression to permit direct access to the states of mind, imagination and creativity needed in situations where ill-structured problems have to be solved. Though, the simple relation assumed and calculated on the laws of association of behavioural properties, the impression could not be substantiated. No simple relation exists between the formats. Frederiksen (1984, p. 198) writes: "... for scores reflecting mean quality of the ideas the correlation between formats was .18 and for scores based on number of ideas, the correlation was .19".

The task of dealing with verbal behaviour seems to be more than of purely scientific concern. In many scientists it creates the illusion of dealing with a person's own creativity and sensibility for other dimensions of comprehension than the quantitative one. The foundation of the hypothesis formulated by Frederiksen seems to be his belief that he has employed two Methods differing in kind in his attempt to objectify human judgment. The results presented do not favour this assumption. One might rather expect that the different constructs are the result of a methodological artefact.

Experiment 1

Method

The model of a modern form of structural psychology assumes an isomorphism of the subjective world of experience (psi) and psycho-physical or mental processes (phi). The subject is the experiencer, the observer, and the reporter. Its language is partly the medium in which this isomorphism is depicted, partly the instrument for discovery of psychological structure and processes. This means that the structural relation is not a causal one but an identity relation.

Subjects. In the economic order humans are valued as a resource. Consequently, the notion "worth" was considered to be of considerable interest to a group of seven doctorate students of Business Administration attending a Behavioural Science course on data collection and analysis. They agreed on the course assignment to investigate the notion empirically.

Material. As a first measure, the notion "worth" or "dignity" has been used as search entry in a computer-based literature search through five different bases: PsycInfo, Sociological Abstracts, ERIC, Modern Language Assoc., and Language Abstracts. Manual searches have been made in dictionaries of the Swedish, English, German, and French Languages. Even the Bible was consulted by some students. Each student had to consult a minimum of ten dictionaries of the following type: Bonniers svenska ordbok, Nusvensk ordbok, The Concise Oxford Dictionary of Current English, A Comprehensive Etymological Dictionary of the English Language, Dictionaire de Synonymes de la Langue Francaise, Dictionaire de l'Academie Francaise Librairie, Duden: Das grosse Wörterbuch der deutschen Sprache, dtv-Wörterbuch der deutschen Sprache.

Design and Procedure. Differentiation plays an important role in the analysis of changes in processes as well as stimulus objects. Without due consideration of individual differences in the extraction of stimulus elements, it is very hard to detect structural invariants. Therefore, the design was layed out in such a way that the categorical response to a particular stimulus element could manifest extreme subjectivity. Completely unstructured dictionary definitions of unknown variability made up the intentional-semantic domain. Each student was asked to function as experiencer, observer, and recorder. As experiencer he would read the definitions with a certain intention, as observer he would respond freely, and as recorder he would itemize the definitions on the basis of relatively unrestricted and unspecified rules. Thus, extreme subjectivity has been introduced on the basis of $d > 10$ dictionaries which have been investigated by $s = 7$ students in order to extract $i < 60$ items for $j = 1$ concepts. No attempts have been made to establish the actual reliability of the dsij-combinations, because the basis for a reliability estimate in the classical psychometric sense should be very poor.

Results

Modelling human ability of detecting the structure of the concept of worth requires a model for estimating human efficiency in finding structural invariants. The division of dictionary definitions into a set of

items was carried out in order to construct a series of matrices of the conventional Nxp type. These make up the prerequisite for ordering the items of the transpose of the original matrices into natural groups. The engaged ordering procedure is based on the method of agglomerative clustering. This means that the (dis)similarity between the items, represented by points in a swarm, can be calculated. The use of

Group 1	Group 2	Group 3
Composure	Dignity	Balanced manner
Peace of mind	Gravity	Position
Pride	Doctoral degree	Triumphal place
Highness	Honour	Nobility
Correctness		
Propriety		
Character		
Without anybody's merit		
Official position		
Characteristic of anybody		

Group 4	Group 5	Group 6
Respectability	Rank	Distinction
Solemnity	Advancement	Popularity
Majesty	Position of esteem	Weightiness
Grandiosity		Tactfulness
Self-respect		Gravity
		Office

Group 7
Honorary title
Position
Style
Arrogance

Figure 1. Collinear Groupings of Dictionary Entries

distance is an appropriate measure, because the measurement process has generated scores of the presence--absence type. The quantitative expression of the distances in the data matrices was calculated according to Ward's (1963) clustering algorithm and estimated with Wishart's (1982) Clustan program. Seven different configurations with varying numbers of groupings have been the result of the students' effort to categorize and systematize their content analytic work. The process of concentrating the items has resulted in at most nine groupings whose empirical definition was based on the premise that there is an obvious break in the configuration. The core of the resulting collinear groupings is the following:

On the basis of the presented differentiation and the proposed names for each of the groupings their prototypical character has been summarized in the following descriptive names: (1) Eigenvalue, (2) Reputation, (3) Reliability, (4) Impartiality, (5) Rank, (6) Significance, and (7) Status. Clustering means that a minimally sufficient number of groups can be determined and that one and the same criterion can be applied to the results of different analyses. But more important is that the configuration of the groupings, despite considerable variation, makes explicit what the invariants are to be extracted out of the data matrices. Invariance can be studied by observing the structured configurations of the demarcated groupings. For that purpose, the relations of the core configuration were studied. The emergent structure is the result of transformations and stable oscillating processes. The entire process shows that two attractors (stable oscillations) control the process depicted in Figure 1. The property of any given point of the curve is an invariant, because it does not change even though the curve is distorted (Woodcock & Davis, 1978, p. 7). The ability to assign termini to the points implies the ability to denominate structural invariants by words. The operating structural connections within the topographical representation deal with the properties of observed discontinuities directly. In the analysis of language as a dynamic system the only reliable observations are the observed discontinuities. This makes topology especially appropriate for a study of the complex mental processes assumed to govern the morphogenesis of text.

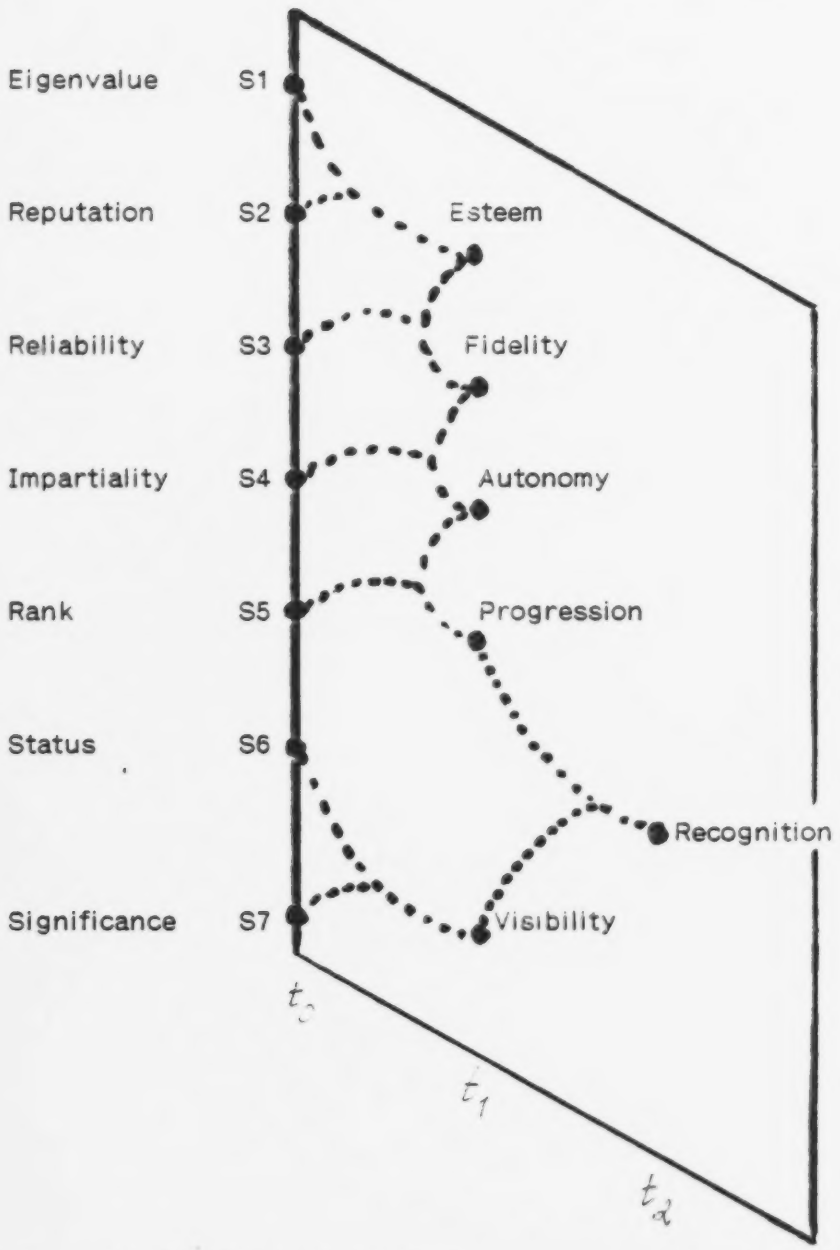

Figure 2. One-Dimensional Space in a Horizontal Plane in which the Dotted Lines Form the Topological Surface

Figure 2 represents a one-dimensional space in a horizontal plane. Though the space in which the attractors form will generally have two or more dimensions. The space interval ($s_1 < s_i < s_7$) marks the state space while the time
interval ($t_0 < t_i < t_2$) encompasses the development of the process. The Space--Time coordinates include a non-linear oscillating process and are therefore the natural choice for the conceptual--semantic Control space ($C = S \times T$) with coordinates (s,t). A point c = (s,t) in C is called a control point and represents a particular invariant. C contains the entire bifurcation set (R^n) which includes the variable X with coordinate x. The variable X represents the Behaviour space (Saunders, 1980, p. 99), because it represents the quantity (in the actual case Error Sum of Squares, ESS) which forms the cusp. The function from C to X is single valued and its most desirable value in forming the clusters is a minimum value of ESS = .000. The n = 7 clusters specify the state variables that are required to specify completely the process. Moreover, they define the Phase space ($P = R^n \times C$) for the process. P_c is a distribution with a unique maximum at x_i. On the other hand, the occurring configuration is not dependent on the number of state variables (Zeeman, 1977). Their number may be very large compared to the controlling factors which in the actual case are two. The dotted cusp lines form the surface of Figure 2. It shows that the function G_c represents the maximum of the curve in the single point (x_i) which is the highest point of the cusp. G_c has two branches, called progression and visibility.

The attractor in the interval ($s_1 < s_i < s_5$) develops smoothly into the singularity *Progression*. At this point a jump occurs which means that the "homeorhesis" (Woodcock & Davis, 1978, p. 12) of the path is disturbed. A different path develops in the interval (s_6, s_7). It is the result of a sudden change in orientation of the developing curve. The curve takes a new and different course. The course is very short and ends in the singularity *Visibility*. When the two control trajectories cross the cusp for the second time a sharp break occurs.

The problem now is to explain the phase transitions. They are of a qualitative nature because the termini are without magnitude measures that would indicate increase or decrease in a given control factor. Moreover, it is not possible to calculate the brink where the sudden

jump occurs. Instead an explanation of the topology produced by the phase transitions is needed. The prototypical names derived from the clusters monitor the metaphoric transformations toward an output that is immediately comprehensible. The behaviour of the first part of the curve is the result of smooth transformations of the initial state until the process reaches its fifth state (s_5).

The name "Eigenvalue" addresses the determinant of weight which defines the quality of behaviour. It encompasses a genuine formula for synthesizing the behaviour and for developing the individual into a responsible agent. The developing process passes through "Reputation" and transforms thereby the initial state toward the degree of "Eigenvalue" which inspires respect by significant others. The result of this metaphoric transformation is the emergence of the first singularity which helps to shape the subsequent course of the process. The term *Esteem* marks the prerequisite for progression. Since so much of an individual's overt behaviour is related to covert moral reasoning it would be unrealistic to forego efforts of inferring it. This means inferring the ability to develop principled moral reasoning. Reliability indicates that a reliable person is one who can be counted upon. By passing through that state, the process has developed into a new point, termed *Fidelity*. As a new limit it gives expression to the degree to which an individual behaves according to the essential characteristics of his personality. The next transforming step involves "impartiality" which implies a moral conduct. All stimulus elements refer to good or proper behaviour and its solemnity. The process develops to the limit described by *Autonomy*. This point determines the person's intellectual ability to penetrate public affairs and personal systems of concepts as the foundation of a strong conviction about the rights and wrongs of public morality, both domestic and international. The centrality of the concept "Rank" concerns the mental power of persons who hold an esteemed position in society. This transforms *Autonomy* into *Progression* which is the highest point of the developed curve. Progression implies that the phases of mental and behavioural development are characterized by distinctive aspects. It implies increasing liberation from various bonding efforts restricting the person in his cooperation with his social environment.

At the moment when the process reaches the highest point of the unfolding curve described by the first path the created dynamic equilibrium is destroyed and the process jumps abruptly into the state (s_6) which initiates the second path. The state is defined by the cluster with the prototypical name "Significance". Its propensity concerns a person's ability to make known the meaningfulness of his knowledge and special skills. The transformational process continues through the state, named "status". The cluster comprises those stimulus elements that refer to the condition of the person's standing in the social order. As a rule, this standing is acquired by effort and competition, making the person overtly convinced of his own importance. The resulting emergent *Visibility* terminates the process. The second path makes it easy to see that adequate social markers are needed in order to manifest individual progression.

The topographic charting of the oscillating process shows two attractors. The result is a curve with two smooth portions linked by an abrupt fall (a sharp frontier). Both paths then develop smoothly into the singularity *Recognition*. The cycle represents a "hysteresis" Woodcock & Davis, 1978, p. 47), because the process suddenly changes direction.

Discussion

Two attractors have governed the process captured in Figure 2. They have their origin in the second limit, termed *Recognition*, i.e. the acknowledgment of a person's achievement. The process discloses that the basic meaning of the dictionary entry "worth" is identical with acquired competence. "Worth" is the result of a successful coordination of conscientious conduct and individual growth. Thus, progression is a reciprocally defined function of both social atmosphere and behavioural endowment. But recognition is possible only if a society has developed a social order that is capable of channelling individual progress properly.

Experiment 2

Method

The energetic model assumes that mental phenomena are the result of energy transformations. It assumes that sensations are subjected to information processing and semantic interpretation by brain mechanisms. Their qualitative segmentation and quantificational resolution is modelled with a behavioural perspective and requires:

(1) A researcher who identifies the discriminating stimulus elements that are descriptive of the object or process to be studied.

(2) Experimental subjects who are asked to make preferential judgments of the intentional-semantic content of pre-designed behavioural statements within a restricted response format.

(3) A statistical analysis of choice alternatives in order to establish a algebraic scale.

Subjects. One hundred and eighty subjects served as voluntary participants. At the time of the experiment (March and April 1986) all volunteers were residents of the Lund-Malmö area of Southern Sweden. One third of the sample consisted of lower division university students who were specializing in Social Science, Law, and Civil Engineering. Another third were adult part-time students who attended courses especially designed for industry and business. Some participants were professionals working at the Department of Business Administration as well as in Advertising. Included were also a class of High School pupils from second grade, studying Business Administration. Of the total sample 47% were female. After an analysis of non-response the scores of 180 subjects could be processed.

Materials. Each of the doctorate students who acted as subjects in Experiment 1 were asked to construct one statement for each of the seven identified clusters. It is worth noting here that the students had no idea of or access to the configuration of Figure 2. The statements had to be formulated on the basis of the analytical content of the clusters. The following instructions were given:

(1) An item has to express one and only one specific property.
(2) Each item has to function within a specified context
(3) An item has to be action oriented.
(4) An item has to be restricted to the judgment of one and only one observation.
(5) An item has to express the object of judgment indirectly.

The conversion of free format responses into a restricted response format implied that the meaning of the clusters was carried over to a set of 50 statements. These were categorized into one and only one of nine successive certainty categories. The rating form were composed in such a way that the rating of each statement could be made independent of the rating of any other in the form. For that purpose, their temporal positions were independently randomized for each experimental subject and for each rating occasion.

Design and procedure. The concept "worth" is made up of dynamic structural relations that are the result of an individual's cooperative interaction with its social environment. This means that an experimental study of the individual's preferential judgments makes sense only if it is possible to specify its context by modelling the social environment. For the projection of social environments the representational function performed by pictures is essential. In the experiment it was possible to use abstract contextual information commercially produced by the Biological Science Curriculum Study in cooperation with King Screen Productions of Seattle. The three narratives used in the experiment illustrate a society founded on (1) behaviour modification, (2) ecology, and (3) growth. The data collection by the doctorate students was governed by a Latin square design and the resulting supermatrix was factoranalytically evaluated.

Results

The results give evidence to the existence of two highly reliable orthogonally behaving factors (alpha $_{max}$ .97, .87). The statements correlating with the first and second factor are the following:

Factor I

2. I have the freedom to express my own opinions.
11. I have the freedom to chose myself the literature I want

to read.

3. I can chose freely my political opinions
7. I can on my own form my life.
40. I may have any religious conception I want to.
13. I can together with my wife/husband decide upon when and how many children we want to get.
5. I dare be myself.
19. I can myself decide where I want to live.
12. The society allows me to fight for my ideals.
15. My power as an individual is tolerated.
27. I can myself chose my clothing.
20. I need not ask others when I shall carry out some action.
30. I have the freedom to chose my childrens' education.
29. I am never forced to join meetings I don't care for.
25. I can influence the society's norms.

Factor II

34. I am treated differently if I have a formal title.
35. My status is dependent on where my place is situated.
32. My status in the society depends on my education.
37. My reputation depends on which persons I am together with.

The items were formulated under the hypothesis that reciprocity provides the conceptual tool and that this relation can be put into words. The mutuality of perceiver and the perceived is thereby parcelled into "quanta of language" and thus primitivized. A series of factoranalytic experiments (Bierschenk, 1987; 1988 a; 1988 b; 1988 c; Bierschenk, Helmersson & Lohmander, 1987) was designed to rule out the possibility that these statements could be a particular mixture of variables. The frequency distribution of the loadings of the final factor solution is given in Table 1.

Table 1.
Frequency Distribution of the Factor Loadings of the Final Factor Solution (Bierschenk, 1988 a, p. 20).

Interval of Positive Loadings	Number of Loadings Factor I	Factor II
.60 - .70	3	2
.70 - .80	10	6
.80 - .90	14	
.90 -1.00	2	

The experiments confirmed that the established factor solution is invariant. The analytical content of the first factor represents the individual's ability to behave vermicularly and to pick up the offerings of its environment. The analytical content of the second factor indicates a need for an organized expression of formal properties of personal progress.

Discussion

All items of the final factor solution of which the presented items are a subset refer to conditions which favour an individual ability to develop worthiness. Logically, a hindrance in the development of worth would be indicated by items correlating with the negative side of the dimensions. Fortunately, the entire set contains some negatively projecting items, though their loadings (in the interval .30 - .50) have been too low for inclusion in the scale. For illustrative purpose they will be given here:

Factor I
55. I can develop my own identity only by belonging to a group.
57. My friends show disapproval if I deviate from their expectations.
56. What others see as right or wrong decides my freedom of action.
Factor II

33. I live under the same living conditions which our parents have lived and which our children will live
54. It is my obligation to work for the best of everyone.

These items give a clear hint to the disturbing effect of collectivity on the development of worth. The items refer to situations where the individual is dependent on the value judgment of unspecified others representing public morality before an action can be carried out. Moreover adaptation to a static social environment is addressed.

General Discussion

The conclusion to be drawn from the factor configuration is that the quantitative and qualitative structure of the investigated concept is qualitatively invariant. The non-linear and the linear scale measure one and the same structure, i.e. a qualitative conclusion is valid. People who are able to develop worth permit themselves to pursue a given goal in life without regard of the public opinion. Generally, people who seek recognition are achievement motivated. They value independence and freedom of action and prefer to be able to control their own life. Moreover, access to information and freedom of expression are indispensable. Subordination of personal identity to public morality will prevent the development of worth. In conclusion, the topological scale is the preferable one, because it gives a synthetic representation of the underlying structure. In contrast, the algebraic scale can only give an analytic representation of details. As it has become obvious, the topological scale is direct and allows an easy translation of its mathematical properties back into theoretical conclusions. The opposite holds for the algebraic scale, because one cannot add one item to another or one factor to another to give a third.

References

Bierschenk, B, & Bierschenk, I. (1976). *A system for a computer-based content analysis of interview data.* Lund: CWK Gleerup.

Bierschenk, B. (1978). *Innehållsanalys som forskningsmetod* (Content analysis as research method) (Kompendieserien, No 25). Malmö, Sweden: School of Education.

Bierschenk, B. (1987). *Perception of quality of life* (Kognitionsvetenskaplig forskning, No. 16). Lund, Sweden: Lund University, Department of Psychology.

Bierschenk, B. (1988 a). *The visual cliff transformed. A factoranalytic definition* (Kognitionsvetenskaplig forskning, No. 25). Lund, Sweden: Lund University, Department of Psychology. (ERIC Document Reproduction Service, No. ED , TM 013 836)

Bierschenk, B. (1988 b). *The spirit of human enterprise. A multivariate approach to a study of projected social organizations* (Kognitionsvetenskaplig forskning, No. 26). Lund, Sweden: Lund University, Department of Psychology.

Bierschenk, B. (1988 c). A theoretical basis for estimating quality of life. *European Journal of Political Economy*, 4, 323-332.

Bierschenk, B., Helmersson, H., & Lohmander, B. (1987). *Worthiness as behavioural component* (Kognitionsvetenskaplig forskning, No 17). Lund, Sweden: Lund University, Department of Psychology.

Biological Sciences Curriculum Study, & Crystal Productions (1976). *The program guide to projections for the future.* Boulder, CO: Biological Sciences Curriculum.

Bock, R.D., & Jones, L.V. (1968). *The measurement and prediction of judgment and choice.* San Francisco: Holden-Day.

Frederiksen, N. (1984). The real test bias. Influences of testing on teaching and learning. *American Psychologist, 39,* 193-202.

Gottschalk, C. A., Lolas, F., & Viney, L. L. (1986). *Content analysis of verbal behaviour.* Berlin: Springer Verlag.

Horst, P. (1966). *Psychological measurement and prediction.* Belmont, CA: Wadsworth.

Osgood, C.E., Saporta, S., & Nunnally, J. C. (1954). Evaluative assertion analysis. *Litera, 1,* 47-102.

Lord, F. M., & Novick, M. R. (1968). *Statistical theories of mental test scores.* Reading, MA: Addison-Wesley.

Saunders, P. T. (1980). *An introduction to catastrophe theory.* Cambridge: Cambridge University Press, 1980.

Stevens, S. S. (1975). *Psychophysics. Introduction to its perceptual, neural and social prospects.* New York: Wiley.

Torgerson, W. S. (1958). *Theory and models of Scaling.* New York: Wiley

Ward, J.H. (1963). Hierarchical grouping to optimize an objective function. *Journal of the American Statistical Association, 58,* 236-244.

Wishart, D. (1982). *Clustan: User manual* (Inter-University Research Council Series No. 47). Edinbourgh: Edinbourgh University, Program Library Unit.

Woodcock, A., & Davis, M. (1978). *Catastrophe theory.* New York: Avon.

Zeeman, E. C. (1977). *Catastrophe theory. Selected papers 1972-1977.* Reading, MA: Addison-Wesley, 1977.

Author Notes

The following doctorate students have been instrumental in the data collection of Experiment 1 and 2: Gunnar Barkenhammar, Ronny Fransson, Michael Frei, Anders Hytter, Stein Kleppstoe, Lars Olbert and Michael Serk.

Helge Helmersson has my gratitude for quick and efficient work in carrying out the computer programmes.

The audiovisual material on "projections for the future " were used with the permission of its producer: The Biological Science Curriculum Study P.P. Box 930 Boulder, CO, 80302.